THE WETLAND VASCULAR FLORA OF FOUR SEEPS IN MCDONOUGH COUNTY, ILLINOIS

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ABSTRACT: The wetland vascular floras of four herbaceous-dominated west-central Illinois seeps that drain into tributaries of the Lamoine River were studied during 1983. Three were alkaline seeps and one was acid. Although there were some floristic differences among the seeps, in totality there were represented three divisions, 37 families, 71 genera and 122 species recorded with the Magnoliophyta being the largest taxon. Only seven species (5.7%) occurred in all four seeps.

INTRODUCTION

The four seeps in west-central Illinois which are the subjects of this paper became of interest when a cursory visit to each revealed obvious floristic differences that attracted attention. The Good Hope Marsh was the only one with Aster umbellatus, Saxifraga pensylvanica and Gentiana andrewsii, the Acorus Seep was the only one with Acorus calamus (which grew in a rather large stand), Spring Lake Seep was the only one with Solidago patula and the Argyle Lake Sphagnum Seep was dominated with the moss Sphagnum. Also in one or more of these seeps were the less common plants Chelone glabra, Pedicularis lanceolata, Aster puniceus and Caltha palustris. Knowing that these kinds of habitats are not common in west-central Illinois and that they should be appreciated and hopefully preserved, we decided to investigate them more thoroughly from a floristic viewpoint in order to make a record of some baseline data about them for future monitoring and comparison.

The Good Hope Marsh and the Lake Argyle Sphagnum Seeps are on the Illinois Natural Areas Inventory. O'Flaherty et al., (1975) described the Lake Argyle Sphagnum Seep from a bryological basis (including the report of a state record, Sphagnum fimbriatum Wils. ex J. Hook.) detailing the physical description and soil and water analyses. In east-central Illinois, Ebinger (1978) studied the vascular flora of seven hillside seeps. Parker and Ebinger (1971) studied the ecology of a hillside marsh and Phipps and Spear (1958) studied a hillside marsh.

METHODS

Each seep was visited at least once a month from March through October 1983. Voucher specimens are deposited in the R. M. Myers Herbarium of Western Illinois University (MWI). Mohlenbrock (1975)

was the source for the family and species nomenclature.

DESCRIPTION OF STUDY AREAS

The four seeps studied are in central McDonough County, Illinois within about a six mile radius from Macomb and within a 12 mile distance from each other. They are more or less tongue-shaped and occur on the south side of tributaries (into which they drain) of the Lamoine River which traverses central McDonough County from a northeast to southwest direction.

Good Hope Marsh (Fig. 1)--Located 3 miles east of Good Hope at the east side of county road 1500 E. Although this seep occurs on both sides of the road this study only includes the approximately 75,600 sq. ft. (420' x 180') on the east side. In the center of the marsh on August 1, 1983 the air temperature was 79°F and the water temperature 66°F with a pH 7.0. The seep is not shaded. The adjacent vegetation is a heavily grazed old field with scattered trees of Gleditsia triacanthos. Crataegus spp., Maclura pomifera, and Morus alba as well as scattered shrubs of Ribes spp., Rosa multiflora, and Symphoricarpos orbiculatus.

Acorus Seep (Fig. 2)--Located about 300 feet east of Good Hope Marsh with an area of about 65,100 sq. ft. (465' x 140'). In the center of the seep on August 1, 1983 the air temperature was 84°F and the water temperature 75°F with a pH 7.3. The seep is not shaded and the adjacent vegetation is the same as Good Hope Marsh.

Spring Lake Seep (Fig. 3)--Located about four miles northwest of Macomb in the northeastern part of Spring Lake Park and about six miles southwest of Good Hope Marsh, this seep consists of about 7,425 sq. ft. (165' x 45'). This seep, more of a hillside seep, is heavily shaded by the adjacent dense mesic woods the principal canopy trees at the perimeter being Juglans nigra, J. cinerea, Fraxinus americana, Carya spp., Quercus rubra, Q. imbricaria, Q. alba and Tilia americana. The main understory trees are Prunus serotina, Ostrya virginiana and Ulmus sp. The shrub Cornus racemosa was also present. In the center of the seep on August 1, 1983 the air temperature was 75°F and the water temperature 71°F with a pH 7.6.

Argyle Lake Sphagnum Seep (Fig. 4)--Located about six miles west of Macomb in the southwestern part of Argyle Lake State Park and about six miles southwest of Spring Lake Seep, this seep consists of about 986 sq. ft. (58' x 17'). This seep, which is a hillside coal seep dominated by the moss Sphagnum, is heavily shaded by the adjacent dense mesic woods. The principal canopy trees around it are Acer saccharum, Quercus rubra, Q. alba, Carya spp., Ulmus sp., and Fraxinus americana, with a few Betula nigra at the edge. The main understory trees are Ostrya virginiana, Amelanchier arborea and Prunus serotina. In the center of the seep on August 1, 1983 the air temperature was 66°F and the water temperature 65°F with a pH 3.5.

Figure 2. Acorus Seep

Figure 4. Argyle Lake Sphagnum Seep

Figure 1. [illegible]

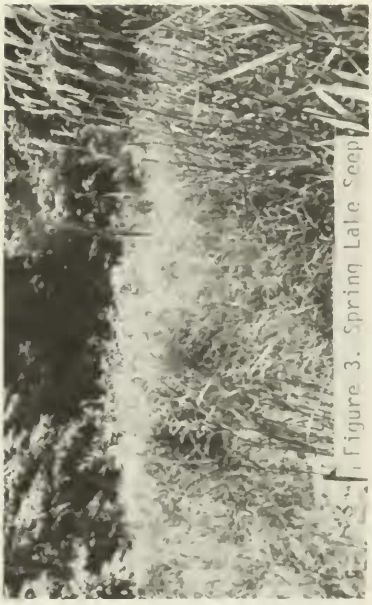

Figure 3. Spring Lake Seep

LIST OF THE WETLAND SPECIES

GH = Good Hope Marsh, Sp = Spring Lake Seep, Ac = Acorus Seep, Ar = Argyle Lake Sphagnum Seep, * = alien species

DIVISION EQUISETOPHYTA
EQUISETACEAE
GH,Sp Equisetum arvense L.

DIVISION POLYPODIOPHYTA
POLYPODIACEAE
GH,Sp,Ac Onoclea sensibilis L.
GH,Sp Thelypteris palustris Schott var. pubescens (Laws.) Fern.

DIVISION MAGNOLIOPHYTA
CLASS LILIOPSIDA
ALISMACEAE
GH,Sp Alisma subcordatum Raf.
Sp Sagittaria brevirostra Mack. & Bush
GH, Ac Sagittaria latifolia Willd.

ARACEAE
Ac Acorus calamus L.

CYPERACEAE
Ac,Ar Carex cristatella Britt.
GH,Sp,Ac Carex hystricina Muhl.
GH Carex lacustris Willd.
Sp Carex laevivaginata (Kukenth.) Mack.
GH Carex lanuginosa Michx.
Sp Carex lurida Wahlenb.
GH, Ac Carex scoparia Schk.
GH Carex sterilis Willd.
Sp, Ar Carex stipata Muhl.
GH,Sp,Ac Carex stricta Lam.
Sp Carex trichocarpa Muhl.
GH, Ac Carex vulpinoidea Michx.
GH Cyperus esculentus L.
Sp Cyperus ferruginescens Boeckl.
GH Cyperus rivularis Kunth
GH,Sp,Ac Cyperus strigosus L.
GH,Sp,Ac Eleocharis erythropoda Steud.
GH Eleocharis obtusa (Willd.) Schult.
GH Eleocharis obtusa (Willd.) Schult. var. detonsa (Gray) Drap. & Mohlenbr.
GH,Sp,Ac Scirpus atrovirens Willd.
GH Scirpus cyperinus (L.) Kunth
GH Scirpus pendulus Muhl.
GH,Sp,Ac Scirpus validus Vahl

JUNCACEAE
GH Juncus dudleyi Wieg.
GH Juncus interior Wieg.

LEMNACEAE
GH,Sp,Ac Lemna minor L.
Sp Spirodela polyrhiza (L.) Schleiden

POACEAE
Ar Agrostis scabra Willd.
GH Alopecurus carolinianus Walt.
GH Calamagrostis canadensis (Michx.) Beauv.
GH,Sp,Ac,Ar Echinochloa pungens (Poir.) Rydb.
Sp Echinochloa pungens (Poir.) Rydb. var. wiegandii Fassett
GH,Sp,Ac,Ar Glyceria striata (Lam.) Hitchcock
GH,Sp Glyceria striata (Lam.) Hitchcock var. stricta (Scrib.) Fern.
GH,Sp,Ac,Ar Leersia oryzoides (L.) Swartz
Sp, Ar Leersia virginica Willd.
Sp Phalaris arundinacea L.
GH Sphenopholis obtusata (Michx.) Scribn.
Ac Sphenopholis obtusata (Michx.) Scribn. var. major (Torr.) Erdman

TYPHACEAE
GH, Ac Typha latifolia L.

CLASS MAGNOLIOPSIDA
ACERACEAE
Ar Acer saccharinum L.

ASCLEPIADACEAE
GH,Sp Asclepias incarnata L.

BALSAMINACEAE
GH,Sp,Ac Impatiens biflora Walt.

BETULACEAE

Ar *Betula nigra* L.

CAMPANULACEAE

GH, Ac *Campanula aparinoides* Pursh
GH,Sp,Ac *Lobelia siphilitica* L.

COMPOSITAE

Sp, Ar *Aster lateriflorus* (L.) Britt.
GH, Ac *Aster novae-angliae* L.
GH *Aster praecaltus* Poir.
GH *Aster puniceus* L.
GH,Sp,Ac *Aster puniceus* L. var. *lucidulus* Gray
Sp,Ac *Aster simplex* Willd.
GH *Aster umbellatus* L.
GH,Sp, Ar *Bidens aristosa* L.
GH,Sp,Ac,Ar *Bidens cernua* L.
Sp, Ar *Bidens comosa* (Gray) Wieg.
GH, Ac *Bidens coronata* (L.) Britt.
Sp,Ac,Ar *Bidens frondosa* L.
Sp *Bidens vulgata* Greene
Ar *Eclipta alba* (L.) Hassk.
GH, Ac *Erechtites hieracifolia* (L.) Raf.
GH,Sp,Ac *Eupatorium maculatum* L.
GH,Sp,Ac *Eupatorium perfoliatum* L.
GH, Ac *Helenium autumnale* L.
Sp *Solidago patula* Muhl.

CONVOLVULACEAE

GH, Ac *Cuscuta polygonorum* Engelm.

CORNACEAE

GH, Ac *Cornus obliqua* Raf.
GH, Ac *Cornus racemosa* Lam.

CRUCIFERAE

GH,Sp,Ac *Cardamine bulbosa* (Schreb.) BSP.
GH, Ac *Rorippa islandica* (Oeder) Borbas var. *fernaldiana* Butt. & Abbe
GH *Rorippa sessiliflora* (Nutt.) Hitchc.

GENTIANACEAE

GH *Gentiana andrewsii* Griseb.

HYPERICACEAE

GH, Ac *Hypericum mutilum* L.
GH, Ar *Hypericum punctatum* Lam.

LABIATAE

GH, Ac,Ar *Lycopus americanus* Muhl.
GH *Lycopus uniflorus* Michx.
Sp, Ar *Lycopus virginicus* L.
GH, Ac *Mentha arvensis* L. var. *villosa* (Benth.) S.R. Stewart
GH, Ac *Pycnanthemum virginianum* (L.) Dur. & Jacks.
GH,Sp,Ac,Ar *Scutellaria lateriflora* L.
GH *Stachys palustris* L. var. *homotricha* Fern.

LEGUMINOSAE

GH, Ac *Amorpha fruticosa* L.

LYTHRACEAE

GH *Lythrum alatum* Pursh

OLEACEAE

Ar *Fraxinus americana* L.

ONAGRACEAE

GH,Sp,Ac *Epilobium coloratum* Muhl.
Sp *Jussiaea repens* L. var. *glabrescens* Ktze.
GH, Ac,Ar *Ludwigia alternifolia* L.
GH *Ludwigia palustris* (L.) Ell. var. *americana* (DC.) Fern. & Grisc.
GH *Ludwigia polycarpa* Short & Peter

POLYGONACEAE

GH,Sp,Ac *Polygonum hydropiper* L.
Ar *Polygonum hydropiperoides* Michx.
Sp *Polygonum pensylvanicum* L. var. *laevigatum* Fern.
Sp,Ac,Ar *Polygonum persicaria* L.
GH,Sp,Ac,Ar *Polygonum punctatum* Ell.
GH,Sp,Ac *Polygonum sagittatum* L.
Sp *Rumex altissimus* Wood
Sp,Ac *Rumex crispus* L.

PRIMULACEAE

Sp, Ar *Lysimachia nummularia* L.

RANUNCULACEAE

GH,Sp *Caltha palustris* L.
GH,Sp,Ac *Ranunculus abortivus* L.
Sp *Ranunculus recurvatus* Poir.
Sp *Ranunculus scleratus* L.
Sp *Ranunculus septentrionalis* Poir.

ROSACEAE

GH,Sp Geum laciniatum Murr. var. trichocarpum Fern.

RUBIACEAE

GH Galium obtusum Biegel.
GH,Sp,Ac Galium tinctorium L.

SALICACEAE

GH,Sp,Ac Salix discolor Muhl.
GH, Ac Salix nigra Marsh.
Sp,Ac Salix rigida Muhl.

SAXIFRAGACEAE

GH, Ac Penthorum sedoides L.
GH Saxifraga pensylvanica L.

SCROPHULARIACEAE

GH,Sp,Ac Chelone glabra L.
GH,Sp,Ac Mimulus ringens L.
Sp Mimulus ringens L. var. minthodes (Greene) Grant
GH,Sp,Ac Pedicularis lanceolata Michx.

ULMACEAE

GH,Sp,Ac,Ar Ulmus americana L.

UMBELLIFERAE

Ac Cicuta maculata L.

URTICACEAE

Sp, Ar Boehmeria cylindrica (L.) Siv.
Sp,Ac Pilea pumila (L.) Gray

VERBENACEAE

GH,Sp,Ac Lippia lanceolata Michx.
GH, Ac Verbena hastata L.

FLORISTIC ANALYSIS

The total wetland vascular flora of the four seeps consisted of three divisions (Equisetophyta, Polypodiophyta, Magnoliophyta), 37 families, 71 genera and 122 species (plus six additional varieties). As shown in Table 1 in all seeps the Magnoliophyta (and within it the class Magnoliopsida) contained the most families, genera and species. The Acorus Seep lacked Equisetophyta and the Argyle Seep lacked both Equisetophyta and Polypodiophyta. The Good Hope Marsh had the most families, genera and species while the Argyle Lake Sphagnum Seep had the fewest. Of the 37 families, Good Hope had 30 (81%), Acorus 27 (73%), Spring Lake 23 (62%) and Argyle 13 (35%). Of the 71 genera, Good Hope had 56 (79%), Acorus 47 (66%), Spring Lake 42 (59%) and Argyle 19 (27%). Of the 122 species, Good Hope had 85 (70%), Acorus 63 (52%), Spring Lake 66 (54%) and Argyle 26 (21%). A comparison of the largest families

and genera are shown in Tables 2 and 3. Carex is the largest genus in terms of the number of species in all the seeps except at Argyle where it is Bidens. Carex is the largest monocot genus in all four seeps and Bidens is the largest dicot genus at Spring Lake and Argyle whereas Polygonum is the largest at Acorus and Aster at Good Hope. The Cyperaceae is the largest family in terms of the number of species at Good Hope and Spring Lake whereas the Compositae is the largest family at Acorus and Argyle. The Cyperaceae is the largest monocot family at all the seeps except Argyle where the Poaceae is the largest. The Compositae is the largest dicot family at all four seeps. The relative numbers of woody and herbaceous genera and species are compared in Table 4. There are 10 woody species in seven genera and 112 herbaceous species in 64 genera. Although all of the seeps had woody plants, clearly they are dominated by herbaceous taxa which are about 92% of the species present. Spring Lake had the fewest woody taxa while Argyle had the highest percent woody taxa. Out of the seven woody genera present in the seeps Good Hope, Acorus, and Argyle each had four genera whereas Spring Lake had two. Salix with three species and Cornus with two species were the only genera of the seven to have more than one species each. Ulmus americana was the only woody species to occur in all four seeps. Herbaceous plants occurring in all four seeps were Echinochloa pungens, Glyceria striata, Leersia oryzoides, Bidens cernua, Scutellaria laterfolia, and Polygonum punctatum; these seven species being 5.7% of the 122 species found in all four seeps. Twenty-nine (23.8%) of all species were in three seeps, 40 (32.8%) were common to two seeps and 46 (37.7%) were located in only one seep (23 at Good Hope, 2 at Acorus, 15 at Spring Lake, 6 at Argyle. Table 5). Uncommon wetland species in west-central Illinois occuring in these seeps were Carex laevivaginata, Carex sterilis, Solidago patula, Aster umbellatus, Aster puniceus, Lycopus uniflorus, Galium tinctorium, Saxifraga pensylvanica, Campanula aparinoides and Caltha palustris. Per Mohlenbrock and Ladd (1978) the four taxa Campanula aparinoides, Carex sterilis, Aster puniceus (although the variety lucidulus has been reported by Scott and Henry (1982)) and Glyceria striata var. stricta (this variety has not been previously reported) have not been attributed to McDonough County and thus are county records. All four of these plants were found in (but all not limited to) Good Hope. Out of the 122 species only four (3.3%) were aliens (Lysimachia nummularia, Polygonum hydropiper, Polygonum persicaria, Rumex crispus) indicating a low invasion by non-indigenous wetland species to date. Spring Lake had all four species, Acorus had three, Argyle had two and Good Hope one.

GENERAL VEGETATION SUMMARY

Although this study is primarily floristic, some general vegetational observations are included here. A detailed ecological study would be desirable and should be done.

Table 1

Family, Genera and Species Analysis of the Four Seeps

	Good Hope Marsh		Acorus Seep		Spring Lake Seep		Argyle Lake Sphagnum Seep		Total
	Number	%	Number	%	Number	%	Number	%	
Families									
Equisetophyta	1	3.3	0	0	1	4.3	0	0	1
Polypodiophyta	1	3.3	1	3.7	1	4.3	0	0	1
Magnoliophyta	28	93.4	26	96.3	21	91.4	13	100	35
Liliopsida	6	20	6	22.2	4	17.4	2	15.4	7
Magnoliopsida	22	73.3	20	74.1	17	73.9	11	84.6	28
Total	30	100	27	100	23	100	13	100	37
Genera									
Equisetophyta	1	1.8	0	0	1	2.4	0	0	1
Polypodiophyta	2	3.6	1	2.1	2	4.8	0	0	2
Magnoliophyta	53	94.6	46	97.9	39	92.8	19	100	68
Liliopsida	15	26.8	12	25.5	12	28.6	5	26.3	19
Magnoliopsida	38	67.9	34	72.3	27	64.3	14	73.7	49
Total	56	100	47	100	42	100	19	100	71
Species									
Equisetophyta	1	1.2	0	0	1	1.5	0	0	1
Polypodiophyta	2	2.4	1	1.6	2	3.0	0	0	2
Magnoliophyta	82	96.4	62	98.4	63	95.5	26	100	119
Liliopsida	28	32.9	17	27	20	30.3	7	26.9	40
Magnoliopsida	54	63.5	45	71.4	43	65.2	19	73.1	79
Total	85	100	63	100	66	100	26	100	122

Table 2

The Largest Families in the Four Seeps

Seep	Families								
	Total			Liliopsida			Magnoliopsida		
	Family	Number of Species	%	Family	Number of Species	%	Family	Number of Species	%
Good Hope Marsh	Cyperaceae	16	18.8	Cyperaceae	16	18.8	Compositae	11	12.9
	Compositae	11	12.9	Poaceae	6	7.1	Labiatae	6	7.1
	Poaceae	6	7.1				Onagraceae	4	4.7
	Labiatae	6	7.1						
Acorus Seep	Compositae	10	15.9	Cyperaceae	9	14.3	Compositae	10	15.9
	Cyperaceae	9	14.3	Poaceae	4	6.3	Polygonaceae	5	7.9
	Polygonaceae	5	7.9				Labiatae	4	6.3
Spring Lake Seep	Cyperaceae	11	16.7	Cyperaceae	11	16.7	Compositae	11	16.7
	Compositae	11	16.7	Poaceae	5	7.6	Polygonaceae	7	10.6
	Polygonaceae	7	10.6				Ranunculaceae	5	7.6
	Poaceae	5	7.6						
	Ranunculaceae	5	7.6						
Argyle Lake Sphagnum Seep	Compositae	6	23.1	Poaceae	5	19.2	Compositae	6	23.1
	Poaceae	5	19.2	Cyperaceae	2	7.7	Labiatae	3	11.5
	Polygonaceae	3	11.5				Polygonaceae	3	11.5
	Labiatae	3	11.5						

Table 3

The Largest Genera in the Four Seeps

Seep	Genera								
	Total			Liliopsida			Magnoliopsida		
	Genus	No. of Species	%	Genus	No. of Species	%	Genus	No. of Species	%
Good Hope Marsh	Carex	7	8.2	Carex	7	8.2	Aster	4	4.7
	Scirpus	4	4.7	Scirpus	4	4.7	Bidens	3	3.5
	Aster	4	4.7	Cyperus	3	3.5	Polygonum	3	3.5
							Ludwigia	3	3.5
Acorus Seep	Carex	5	7.9	Carex	5	7.9	Polygonum	4	6.3
	Polygonum	4	6.3	Scirpus	2	3.2	Salix	3	4.8
	Salix	3	4.8				Bidens	3	4.8
	Bidens	3	4.8				Aster	3	4.8
	Aster	3	4.8						
Spring Lake Seep	Carex	6	9.1	Carex	6	9.1	Bidens	5	7.6
	Bidens	5	7.6	Cyperus	2	3.0	Polygonum	5	7.6
	Polygonum	5	7.6	Scirpus	2	3.0	Ranunculus	4	6.1
	Ranunculus	4	6.1	Leersia	2	3.0	Aster	3	4.5
Argyle Lake Sphagnum Seep	Bidens	4	15.4	Carex	2	7.7	Bidens	4	15.4
	Polygonum	3	11.5	Leersia	2	7.7	Polygonum	3	11.5
	Carex	2	7.7				Lycopus	2	7.7
	Leersia	2	7.7						
	Lycopus	2	7.7						

Table 4

The Woody and Herbaceous Plant Components of the Four Seeps

	Good Hope Marsh		Acorus Seep		Spring Lake Seep		Argyle Lake Sphagnum Seep		Total	
	Genera	Number of Species	Genera	Number of Species	Genera	Number of Species	Genera	Number of Species	Genera	Number of Species
Woody	Cornus	2	Salix	3	Salix	2	Acer	1	Salix	3
	Salix	2	Cornus	2	Ulmus	1	Betula	1	Cornus	2
	Amorpha	1	Amorpha	1			Fraxinus	1	Acer	1
	Ulmus	1	Ulmus	1			Ulmus	1	Betula	1
									Amorpha	1
									Fraxinus	1
									Ulmus	1
Total	4(71%)	6(7.1%)	4(8.5%)	7(11.1%)	2(4.8%)	3(4.5%)	4(21.1%)	4(15.4%)	7(9.9%)	10(8.2%)
Herbaceous Total	52 (92.9%)	79 (92.9%)	43 (91.5%)	56 (88.9%)	40 (95.2%)	63 (95.5%)	15 (78.9%)	22 (84.6%)	64 (90.1%)	112 (91.8%)

Table 5

Species Located at Only One Seep

GOOD HOPE (23)	SPRING LAKE (15)
Carex lacustris	Sagittaria brevirostra
Carex lanuginosa	Carex laevivaginata
Carex sterilis	Carex lurida
Cyperus esculentus	Carex trichocarpa
Cyperus rivularis	Cyperus ferruginescens
Eleocharis obtusa	Spirodela polyrhiza
Scirpus cyperinus	Phalaris arundinacea
Scirpus pendulus	Bidens vulgata
Juncus dudleyi	Solidago patula
Juncus interior	Jussiaea repens glabrescens
Alopecurus carolinianus	Polygonum pensylvanicum laevigatum
Calamagrostis canadensis	Rumex altissimus
Aster praealtus	Ranunculus recurvatus
Aster umbellatus	Ranunculus scleratus
Rorippia sessiliflora	Ranunculus septentrionalis
Gentiana andrewsii	
Lycopus uniflorus	ARGYLE LAKE (6)
Stachys palustris homotricha	
Lythrum alatum	Agrostis scabra
Ludwigia palustris americana	Acer saccharinum
Ludwigia polycarpa	Betula nigra
Galium obtusum	Eclipta alba
Saxifraga pensylvanica	Fraxinus americana
	Polygonum hydropiperoides
	ACORUS (2)
	Acorus calamus
	Cicuta maculata

Good Hope Marsh--There are six rather distinct vegetational zones. In order from south (mouth) to north (source) they and their principal genera are: 1--sedge meadow (Eleocharis, Carex, Scripus), 2--shrub zone (Amorpha fruticosa), 3--sedge meadow (Carex), 4--herbaceous zone (Typha, Impatiens, Bidens, Sagittaria, Polygonum), 5--tree and shrub (woody) zone (Ulmus, Cornus, Amorpha, Salix) and 6--herbaceous zone of the southern and eastern edge surrounding the spring which is the major source of water (Glyceria, Carex, Scirpus, Eupatorium, Sagittaria, Onoclea and Impatiens being the major plants but also including Pedicularis, Gentiana, Chelone and Saxifraga). Carex lacustris and C. stricta were the dominant and sub-dominate sedges respectively.

Acorus Seep--Likewise has six rather distinct zones from the south (mouth) to north (source): 1--grass meadow which is about 50% the length of this seep (Glyceria), 2--sedge meadow (Eleocharis, Carex, Scirpus, with herbs as Sagittaria, Impatiens, Eupatorium and particularly on the west side Polygonum), 3--cattail zone (Typha) particularly at the west-central location, 4--sweet-flag zone (Acorus) which occupies about 25% of the seep's length, 5--tree and shrub (woody) zone east of the Acorus (Ulmus, Salix, Cornus, Amorpha), and 6--herbaceous zone of the southern and eastern edge surrounding the main water source (Glyceria, Sagittaria, Eupatorium, Carex, Impatiens, Typha, Scirpus). Carex hystricina and C. stricta were the dominant and sub-dominant sedges respectively.

Spring Lake Seep--This seep is not clearly zoned but is basically a sedge meadow (Carex) with the other species scattered throughout including a small grouping of several small woody plants (Ulmus, Salix) in the center. Along the lake edge (mouth) of the seep is a moderate stand of Phalaris where as at the eastern edge (a major source of the seep's water) there is a good stand of Impatiens.

Argyle Lake Sphagnum Seep--There is no zonation. The recorded species are generally scattered throughout the Sphagnum mat although most plants are near the periphery and the grass species appear to form a narrow band at the top and bottom of the seep.

DISCUSSION AND SUMMARY

These four herbaceous-dominated seeps, within a 12 mile distance of each other, occur on the south side of tributaries of the Lamoine River. The most apparent differences among them (excluding size) is that (a) one (Argyle) is an acid seep whereas the others are near neutral or alkaline, (b) two (Argyle and Spring Lake) are hillside seeps whereas the other two are not on such slopes, (c) two (Argyle and Spring Lake) are shaded and the other two are not, (d) two (Good Hope and Acorus) are surrounded by disturbed vegetation whereas the other two are not, and (e) two (Good Hope and Acorus) had generally well defined vegetation zones which the other two did not. Although the general floristic characters were similar in all the seeps, several differences were apparent (a) the acid seep (Argyle) clearly had fewer species than the others, (b) Carex was the genus with the most species in all the seeps except Argyle where Bidens was the largest genus, (c) only seven species (5.7%) were found in all four seeps (Ebinger (1978) found eight (8.4%) species in all seven seeps he studied in east-central Illinois), and (d) forty-six (37.7%) species were located in only one seep (Ebinger (1978) found 38 (40%) species at only one of his seven seeps in east-central Illinois which he considers to be due to chance dissemination, degree of disturbance and habitat differences).

At the present time the seeps' floristic integrity seem not to be seriously threatened by alien wetland species since the latter

component is rather low (3.3%), although present in all four seeps. The list of vascular plants from this seep study includes only characteristic wetland species. There were, however, some other species present in the seeps. These were species of the surrounding vegetation and occurred in the seeps usually at the periphery in small numbers and generally could not be considered as present threats to the seeps' floristic integrity. However, we feel it is important to state our comments about possible threats to each seep:

Good Hope Marsh and Acorus Seep--These are considered together since the threats are identical. There is a serious problem with cattle grazing around these privately owned seeps. They graze into the seep as far as they can, which varies with the water level. The edges (except the west edge of Good Hope Marsh which is a road) are severely trampled and often the Acorus in Acorus seep and Gentiana in Good Hope Marsh are badly mutilated. Also the effect of the large quantities of cattle feces and urine which sometimes discolor the water in places must not be neglected and should be evaluated. Species such as Barbarea vulgaris, Taraxacum officinale, Festuca pratensis, Hesperis matronalis, Poa pratensis, Agrostis perennans, Senecio plattensis, Vernonia missurica, Acalypha rhomboidea, Hypericum sphaerocarpum, Apios americana, and Amphicarpa bracteata, although presently not abundant, are often invasive from the surrounding fields.

Spring Lake Seep--There is a large degree of protection for this seep since it is in a publicly (city) owned park. This is the only seep that had all four of the alien wetland species present. Apios americana and Amphicarpa bracteata were common and could be a potential problem and Agrostis alba occasionally occurred. Because this seep borders the lake there is a moderate problem of foot traffic and littering. In 1968 a new dam was completed to enlarge the reservoir and with the rise in water level when the lake enlarged in 1969 the lower part of this seep was submerged. Some of the thus doomed Caltha palustris were transplanted to another nearby smaller and less floristically diverse hillside seep (which did not previously contain this species) in the spring of 1969. Today they are surviving well and spreading.

Argyle Lake Sphagnum Seep--This seep is located in a publicly (state) owned park and some protection is provided. However, a potential major problem is encroachment of woody and herbaceous plants from the surrounding forest. Woody plants are particularly threatening: Quercus rubra (an approximately 15-20 year old tree is in the northwestern part of the seep and there are numerous seedlings throughout), Corylus americana (several seedlings near the edge), Ostrya virginiana (several seedlings near the edge), Parthenocissus quinquefolia (a number of young plants), Prunus? sp. (several seedlings), Quercus (imbricaria?) (2 seedlings), Rubus (allegheniensis?) (one young plant), Rhus sp. (several young), Toxicodendron radicans (several young) Carya sp. (couple seedings),

and some Betula nigra and fewer Ulmus sp. seedlings throughout. Several woodland herbaceous plants such as Potentilla simplex, Claytonia virginica, and Cerastium sp. were in the seep at its edge and are not threatening presently. Most numerous of the herbaceous plants were many Muhlenbergia sylvatica and some Poa pratensis. These grasses were most prevalent near the lake margin. As noted, with the exception of the large red oak tree, the other plants were seedlings or very young. Perhaps the acid substrate will prevent the growth of these plants so that a major problem will not occur but a continued monitoring should be implemented. There is a minor problem at present where a foot path traverses the lower edge of this seep.

As a final comment, it should be noted that there was a severe drought during the course of the study (summer 1983). Although we observed no effect on the seeps, there is a possibility some effect on the flora could have resulted.

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